ART. 18. REPORTS ON THE MARGARET M. CARY AND CARNEGIE MUSEUM EXPEDITION TO BAJA CALIFORNIA, MEXICO, 1961

3. A Portable Ultra-violet Insect Trap

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[This is the third of a series of papers based on the Margaret M. Cary and Carnegie Museum Expedition to Baja California, Mexico. For an account of the itinerary and description of the localities, see the first paper in this series, by Richard M. Fox. In Annals of Carnegie Museum, v. 36, page 181 to 192.]

For the expedition it was important to have the most efficient light trap possible, since a major objective was collecting Sphingidae. From personal experience as well as advice from experienced collectors, Mrs. Cary was particularly interested in the use of black light. There are definite requirements for a trap suitable for such a field trip as was planned. It must be portable, yet packed to withstand rough travel; both lighting and current sources must be interchangeable; it must be literally self-supporting, since in much of the desert area no trees would be available from which to suspend it.

Numerous papers discuss a variety of light traps, but none met our specifications. Frost (1952) summarized many such publications and gave an extensive bibliography, but his emphasis was on those used for pest control, few of which are suitable for traveling field parties. Most of the older traps employed a lantern or incandescent light. Williams (1939), who made a detailed report on moths captured over a period of four years, used a 200-watt gas-filled, clear electric bulb. Robinson and Robinson (1950) studied illuminations effective for moth attraction using a medium power mercury vapor lamp. Holtzman (1961) wrote a specific report on collecting Sphingidae, also using a mercury vapor light source. In discussing collecting at Rancho Grande, Beebe (1949) mentioned their "portable UV machines" but presented no details. Fleming (1947), who was with Beebe, described a variety of collecting equipment with no reference to ultra-violet light in his first or subsequent papers. Peterson's (1934, 1937) exhaustive manual on equipment does not include ultra-violet equipment.

In 1957, Mr. A. C. Lloyd of the Carnegie Museum staff, designed and constructed of cardboard and wire the prototype of a portable light trap, to be used with an electric light. After field testing at Powdermill Nature Reserve, the Museum's research station in Westmoreland County, Pa., a number of permanent models were made of sheet metal and used extensively for moth collecting at the Reserve and elsewhere.

Prior to the Baja California expedition, Mr. Lloyd altered his basic model to utilize black light and made other changes to facilitate portability and flexibility of operation. Construction details of the evolved model are illustrated in Figures 1 to 3, and the assembled trap is shown in Figure 4. It was constructed of galvanized iron with a wooden tripod and fitted to take a standard five gallon food jar as a killing bottle. The entire trap was suspended, when in use, from a heavy eye at the apex of the tripod, and the

Submitted for publication, June 27, 1962
Issued December 24, 1963

vanes are so arranged that a circline ultra-violet tube, an incandescent bulb or a lantern could be used as light source. It could be completely disassembled for flat packing.

The hinged roof was made with an inch overlap at its apex for protection against rain. The two sets of vanes could be folded flat around the center hook. Four trapezoidal funnel sections were hinged together with a loose pin hinge on the fourth side. After a large hole was cut out of a five-gallon jar lid, the rim was welded to a piece which was attached to the bottom of the funnel by means of loose-pin hinges.

The tripod was constructed of 7/8-inch doweling with the legs made in two sections, each three feet long, which could be fitted together by metal collars.

A carrying case, 41 by 16 1/2 by 7 1/4 inches, was built with 7/8-inch plywood sides and top and 1/2-inch poplar bottom and ends. All edges were metal stripped with reinforced corners. The lid was made deep enough so the tripod legs could be secured in it by means of turn bolts. The bottom was subdivided with fiber board partitions to accommodate the rest of the equipment.

The whole ensemble is compact and rugged but too heavy to be lugged for any distance. In the field it was transported by car or pack animal.

Electrical equipment is arranged so the trap can be operated either from house current or a car battery. In the latter case it is desirable to carry an extra battery to facilitate recharging without interference with field work. This was made possible by mounting in the expedition vehicle two batteries connected to a heavy duty generator; a dash-board switch controlled the charging of either one. An inverter is needed to correct the battery current from direct to alternating current. Fig. 3 shows the mounting used for the ultra-violet light and associated equipment. This fixture slides over the cross-bar of the vanes and is equipped with a waterproof male socket to which a waterproof extension cord can be plugged. The circline lamp specified produces, in addition to visible light, ultra-violet black light in the 3600 angstrom range. It requires 110-volt alternating current and is rated at 22 watts. The specific items used were:

Ballast:	General Electric 89-G-499
Starter:	Hubbel FS-2
Starter base:	Hubbel 2947
Circline connection:	General Electric ALF 582-06
Circline lamp:	Westinghouse FC-8-T-9-BL
Inverter:	Cornell-Dubilier 6/12VD6
Safety goggles:	American Optical, Cruxite A, F9946, 6-1/2 CC, 6CVE

It is hardly possible to present irrefutable evidence of the collecting advantages of black light over white since to do so would necessitate the use of two different traps in the same place at the same time. Experiments with living material do not lend themselves to the absolute statistical precision which can be achieved in the physical sciences. Nevertheless, there is much evidence both from the laboratory and the field that ultra-violet light has a stronger attraction for insects. According to Dethier (1953) insects respond to radiations from about 2537 to 7000 angstroms, compared to man's range of approximately 4000 to 7800 (Ford, 1955), and therefore are greatly attracted to black light. Schneirla (1953) states that Lutz (1924) and Bertholf (1932) proved that many insects are attracted to plants by a sensitivity to the ultra-violet emanation from the leaves, not perceived by man. Wigglesworth (1947) in a well documented chapter on insect vision concludes that light-seeking insects show a preference for the ultra-violet range.

Mrs. Cary told the author of an experience she had when collecting in Jamaica. After a number of previous trips there, ultra-violet light was used for the first time in 1957. She said she was utterly astonished at the clouds of insects which appeared compared to the catch of former years.

Since the collecting in Baja California was almost entirely in virgin territory, there is no basis for comparison to offer, but large catches were taken.

The equipment was operated in the field for more than 300 hours, both from battery and from house current and, for a few hours, using a gasoline pressure lantern.

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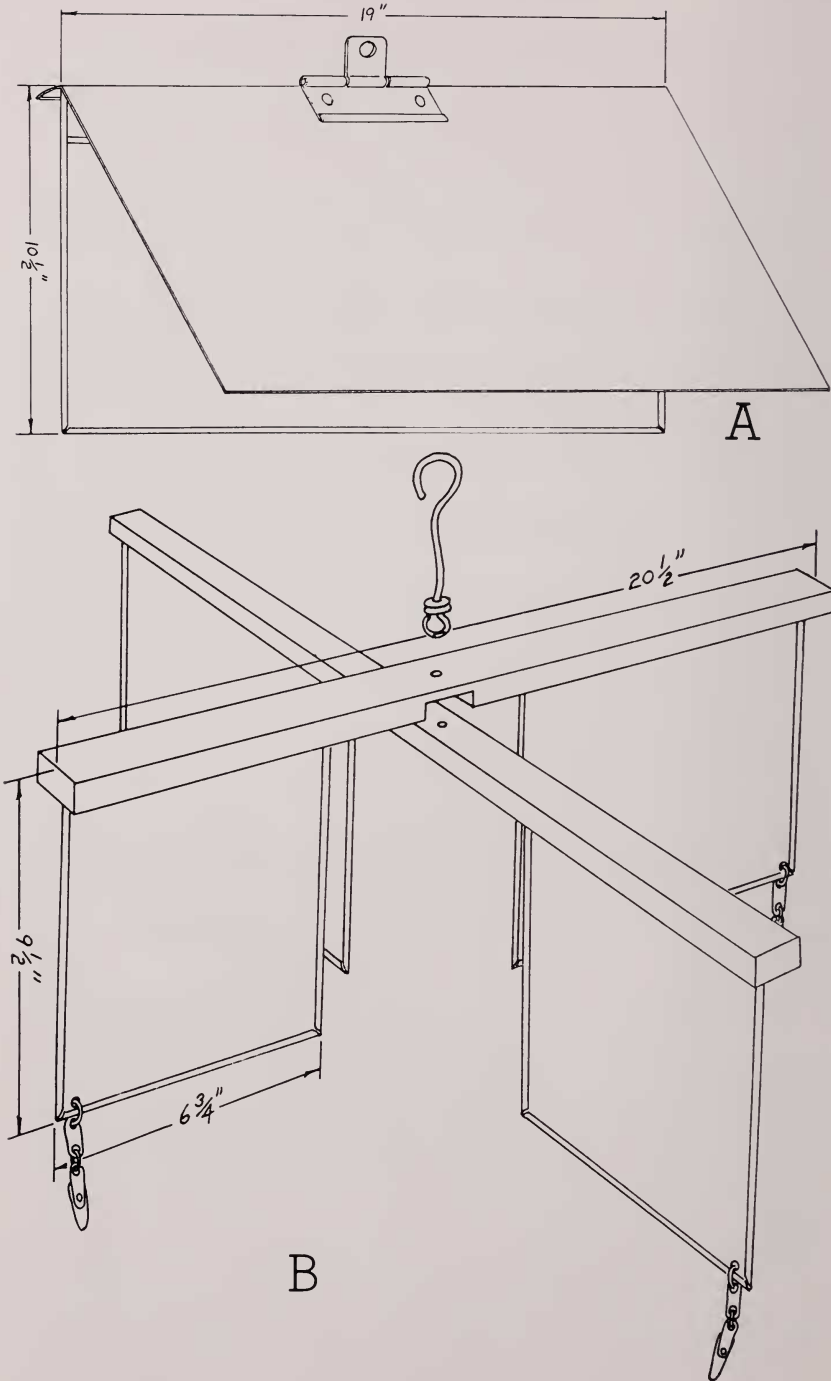
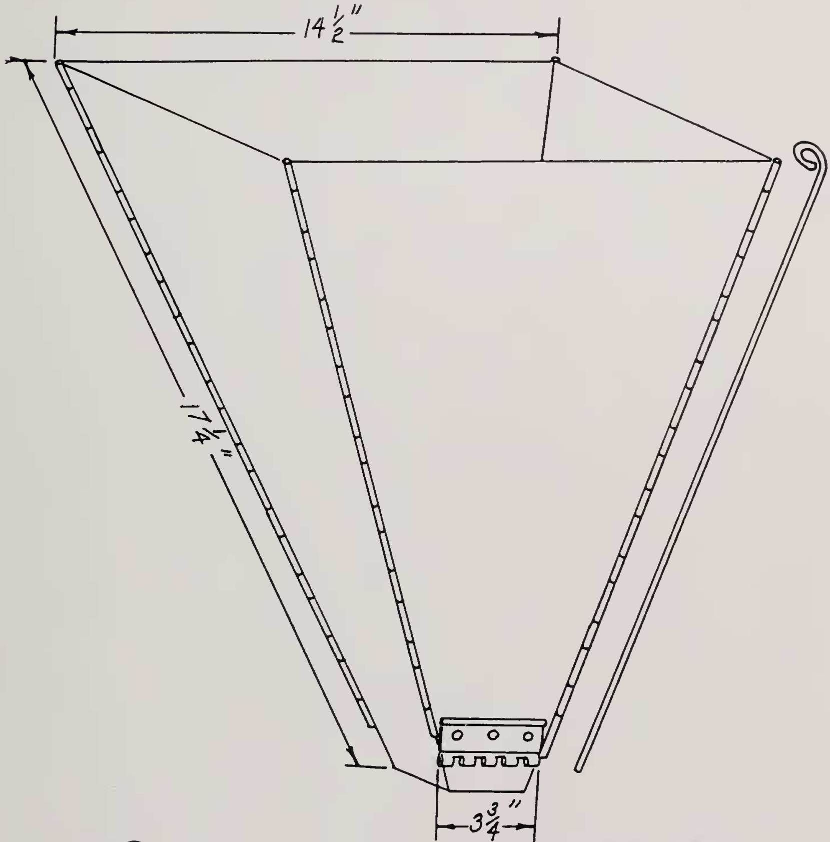


Fig. 1. Details of light trap construction. A. Roof. B. Vanes. C. Funnel



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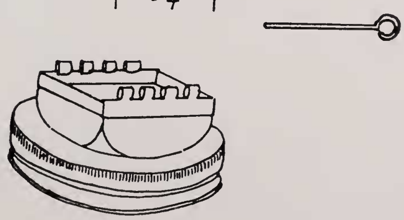

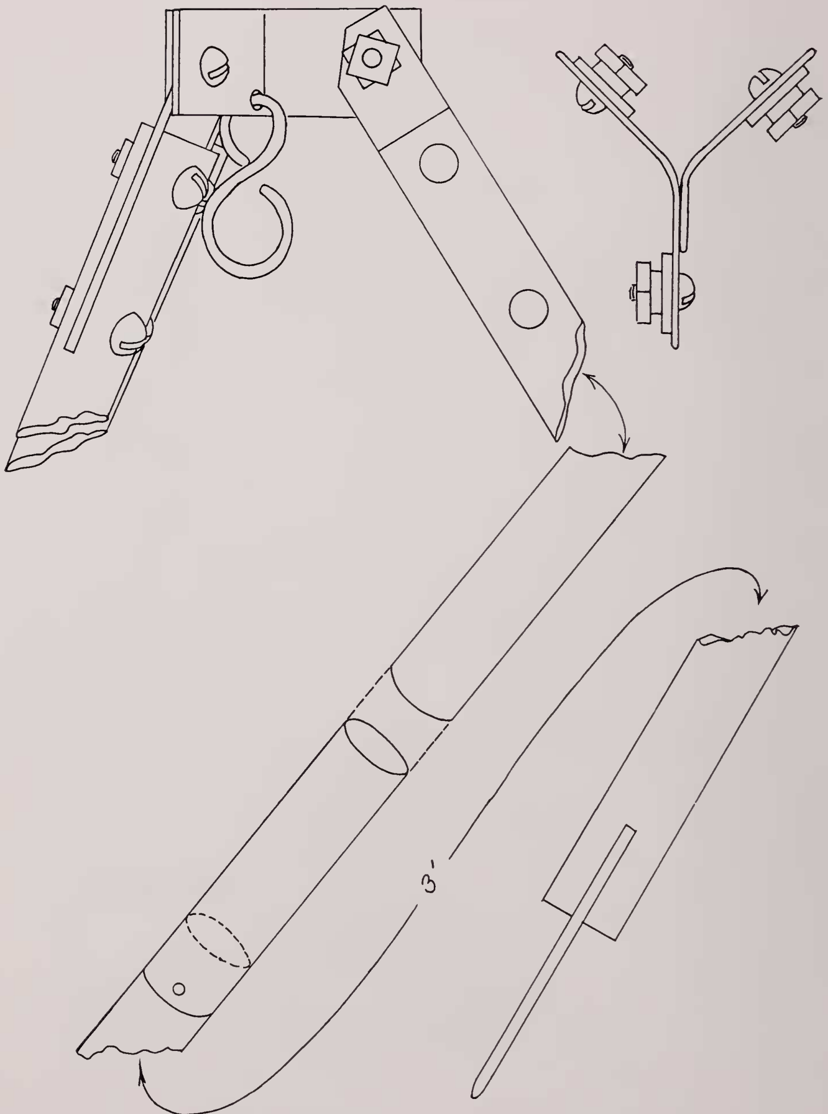

Fig. 2. Details of tripod construction

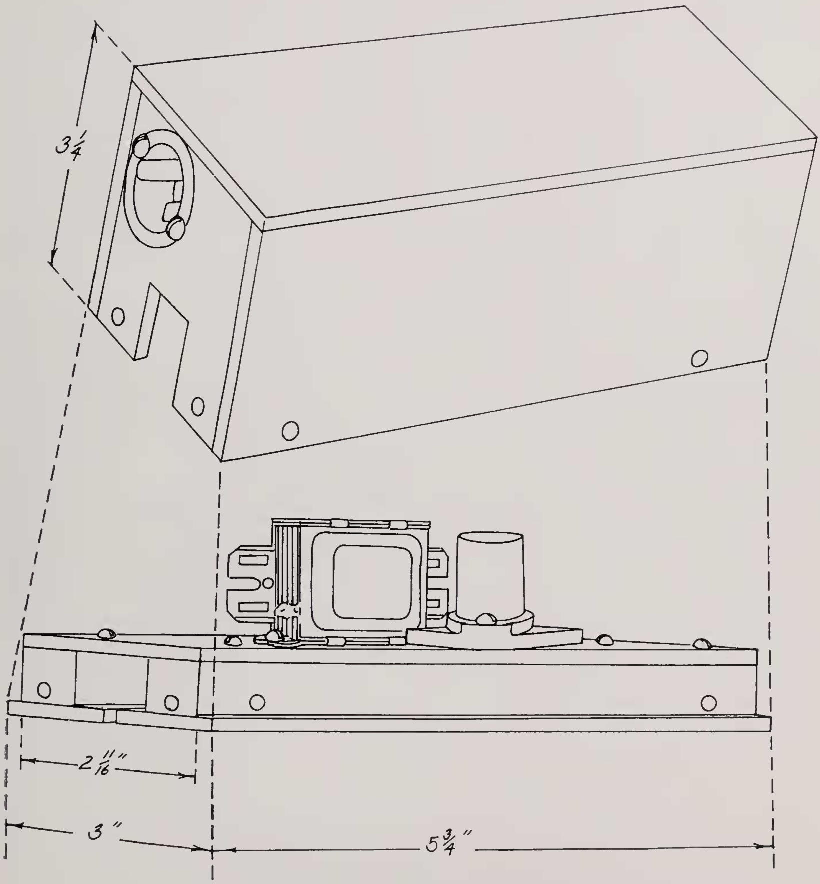

Fig. 3. Electrical equipment assembly
(All drawings by R. T. Satterwhite)

Fig. 4. Expedition members adjusting light trap at operational site in Baja California, Mexico. (Photograph by R. M. Fox)